

Embedding Threshold Concepts: from theory to pedagogical principles to learning activities

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Abstract

In this paper we develop an account of the problems confronting learners by blending insights from threshold concepts and variation theory. In particular, we use both of these ideas to develop a coherent account of the structure of understanding and the implications for learning in the disciplines. On this basis we propose four pedagogic principles and describe three types of activity that seek to operationalise these principles. We report briefly on experience in using these activities in a project 'embedding threshold concepts in first-year undergraduate economics' in four universities in England. We comment on some implications of this experience.

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1 Introduction

If the theory of threshold concepts (Meyer and Land, 2003) is to be useful in guiding teaching and improving student performance, it must be translated into principles that can inform the design of teaching and the curriculum. The aim of this paper is to consider these principles and explore various types of learning activities that aim to embed threshold concepts in economics teaching by putting these principles into practice.

The problem that is being addressed here is expressed by Frank (1998, p.14) in the following terms: ‘When the dust settles, most students leave the introductory course never having fully grasped the essence of microeconomics. Thus, the opportunity cost concept, so utterly central to our understanding of what it means to think like an economist, is but one among hundreds of other concepts that go by in a blur.’ Threshold concepts provide a way of describing the desirable overall learning outcome for students: they have learned to think and practice in the manner of scholars of a discipline, using a coherently structured body of ideas and procedures to analyse problems as they are defined by that discipline. In the words of one economics lecturer quoted by Meyer and Land (2006, p. 15): ‘We want our students to start to think about problems, issues. You get them to formulate, if not explicitly at least implicitly, some kind of formal analytical structure or model that simplifies things but then allows someone to think through a problem in a very structured way.’ The structure of thinking is particularly important in a discipline such as economics in which is currently defined in a very integrated manner with fairly sharp boundaries (Reimann 2005). It is not surprising in these circumstances to find that there are significant ‘learning spillovers’ between the major sub-parts of the discipline (Guest and Vecchio 2003).

However, currently, undergraduate students of economics have little experience of being asked to ‘formulate an analytical structure’. Empirical research (Becker and Watts 1998, Reimann 2005) indicates that there is little variation in students’ experience of learning of undergraduate economics either in the USA or the UK. In the UK their experience consists of fast-paced lectures accompanied by tutorials. Information is transmitted in lectures and then consolidated and applied in tutorials. A survey by Guest and Duhs (2002) in Australia also found that students believed they experienced too much transmission of content and not enough opportunity to apply ideas. In this ‘theory-first’ (McCormick and Vidler 1994) approach to teaching and learning analytical structures are not formulated by students, they are taken as given. A typical outcome of this approach is the one described by Frank. Students acquire a set of concepts that they cannot deploy in a coherent way to make sense of the economic phenomena they experience.

There is already a strong literature suggesting ways in which this problem can be remedied by engaging students with the subject matter of economics in ways that go well beyond ‘chalk and talk’ (e.g. Becker and Watts 1998, Becker *et al.* 2006, Davies 2004). The approaches to teaching and learning suggested in this paper have some similarities with ideas that may be found in the existing literature. However, threshold concepts provide a way of understanding learning in economics that not only offers a coherent rationale for organising teaching in

some ways rather than others but also offers a productive stimulus for generating some new ideas about the kind of teaching which is more likely to be effective. Since 2004 the ‘embedding threshold concepts in first-year undergraduate economics’ (ETC)ⁱ project has been developing this rationale and designing, using and evaluating teaching and learning activities on the basis of this rationale. The project is funded by the Higher Education Funding Council for England and the Department for Employment and Learning (DEL) under the Fund for the Development of Teaching and Learning and it involves a partnership between four universities.

In the next section we first summarise the idea of ‘threshold concepts’ and how they apply in the case of economics. In Section 3 we explain how the theory of threshold concepts has led the project to propose several pedagogical principles for learning activities. In Section 4 we exemplify the types of activity that have been developed by the project and comment on evidence from the use of these activities with students. This evidence is drawn from initial trials with undergraduate students at four universities in England. In Section 5 we discuss some general issues in the design of these activities and some implications for future practice and research.

2 A definition of Threshold Concepts

According to Meyer and Land (2005) threshold concepts define the ‘episteme’ of a discipline: the ‘way of thinking and practising’ that epitomises the type of analysis conducted by scholars of that discipline. As such, threshold concepts act as critical portals in the development of a learner’s understanding of a subject. They argue that these concepts usually have five attributes. They are integrative, transformative, irreversible, bounded and troublesome. These characteristics are inter-related and they follow from the integrating role of these concepts. In one sense, any conceptual change is integrative and transformative, in that it changes a way that an individual experiences the world. They see things differently. However, the terms are used here to indicate the scale of change engendered by the acquisition of a threshold concept.

Since they integrate the thinking of a body of scholarship the acquisition of a threshold concept exerts a profound influence in shaping an individual’s way of thinking. This transformation is social as well as individual since it re-positions the individual in relation to the community of scholars who have developed this way of thinking and in relation to all others who adopt one standpoint or another in relation to the thinking of these scholars. Concepts that are integrative and transformative are more likely to be irreversible because they have opened up a new way of thinking that cannot easily be forgotten. However, this assumption of ‘irreversibility’ does not mean that further change is not possible. Acquisition of further threshold concepts will again transform thinking, but not in ways that involve any retracing of steps to a former position. As threshold concepts define an ‘episteme’ within a discipline they define its boundaries: the way in which they define problems and the way in which they legitimate particular ways of trying to make sense of those problems. The scale of conceptual change involved and the

implications for social relations mean that the acquisition of a threshold concept may well be troublesome.

Davies and Mangan (2005) use a table (here reproduced as Table 1) to show some differences between the conceptual change involved in the acquisition of threshold concepts and conceptual change in the acquisition of basic concepts. The latter term is used here to refer to the way in which a discipline classifies phenomena to create an order that is susceptible to the modes of analysis deployed by the discipline.

Table 1 Definition and exemplification of three types of conceptual change

<i>Type of conceptual change</i>	<i>Type of transformation and integration</i>	<i>Examples in economics</i>
1 Basic	Understanding of everyday experience transformed through integration of personal experience with ideas from discipline.	Distinctions between price/cost; income/wealth (stocks/flows); nominal/real values; investment/saving. Newly met concepts such as real money balances, natural rate of unemployment.
2 Discipline Threshold concepts	Understanding of other subject discipline ideas integrated and transformed through acquisition of theoretical perspective	Interaction between markets, welfare economics, opportunity cost
3 Procedural (in the case of economics – how are models of the economy constructed and evaluated?)	Ability to construct discipline specific narratives and arguments transformed through acquisition of ways of practicing.	Comparative statics (equilibrium, ceteris paribus), time (short-term, long-term, expectations), elasticity

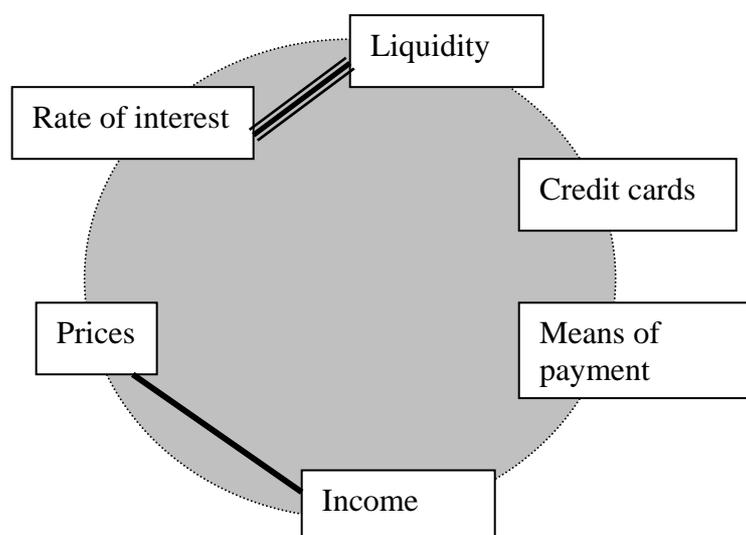
3 Relating theory to pedagogical principles

We base our initial identification of pedagogical implications of this schema on some ideas from variation theory (Pang and Marton 2003, 2005). That is, the term concept (or conception) is used in Table 1 to refer to a way of understanding a phenomenon. Any phenomenon may be understood in qualitatively different ways and each way of understanding highlights some dimensions of that phenomenon and may also presume particular relationships between those dimensions. A dimension of a phenomenon may be one of its characteristics or properties or it

may be an aspect of the context within which the phenomenon is located. The pedagogic principle derived from variation theory is that the teacher should draw the learner's attention to simultaneous variation in the dimensions of a phenomenon that are critical to the desired conception.

How does this principle apply to the 'basic concepts' identified in Table 1? The first row in Table 1 includes conceptual change in which there is discrimination between phenomena that were previously regarded as a single phenomenon. For example, 'money' and 'income' are often used interchangeably in everyday language. Similarly, no distinction is made in everyday language between the idea of a 'stock' of money (e.g. the total amount of notes, coin and bank deposits) and a 'flow' of money being exchanged for other things. Experience of money in everyday life and conversation does not highlight variation in dimensions (particularly those associated with the total amount of money in a society) that lead to the discernment that income, the stock of money and the flow of money are distinct phenomena. The distinction between 'income' and 'money' is necessary to prepare the ground for the distinction between the supply and the demand for money. Some dimensions of the phenomenon 'demand for money' are presented in Figure 1.

Figure 1: Some dimensions of the phenomenon of the demand for money

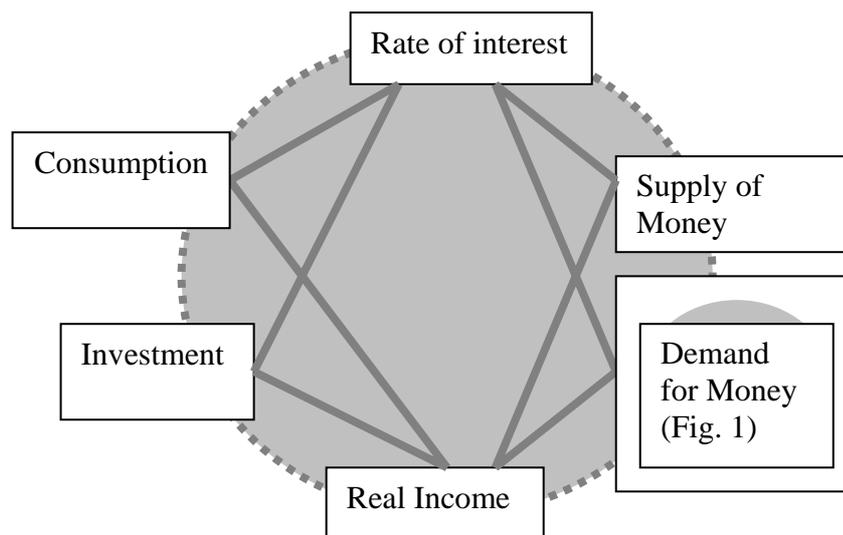


Each of the dimensions identified in Figure 1 is commonly referred to in textbook explanations of the demand for money (see for instance Begg *et al.* 2005 pp. 396-397, Mankiw and Taylor 2006 pp. 611 -612). Variation theory suggests that learners should experience simultaneous variation in each of these dimensions in order to develop a conception of the demand for money in line with these textbook representations. However, there is a complicating factor. These dimensions are not independent of each other. In the case of prices and income the relationship is a simple ratio, since many textbook representations focus on the effect on the demand for money of a change in money income relative to prices in order to present the argument in terms of the effect of ‘real income’. In the case of interest rates and liquidity the relationship is more complex. Individuals may hold their wealth in the form of money or interest bearing savings. The advantage of holding money is that it provides liquidity, but the opportunity cost of holding money is the interest that is foregone by doing so. The nature of these relationships is not visible when all the dimensions are varied simultaneously. Moreover, some relationships between dimensions (such as between the interest rate and liquidity in Figure 1) are characterised by ideas that are specific to the discipline: the ways of thinking and practising that are identified in rows 2 and 3 of Table 1. This distinctive way of integrating concepts in a discipline is the hallmark of threshold concepts. It is evident even more powerfully in more complex models that students encounter later in their studies.

For example, the IS/LM model depicts *interaction between markets* (a discipline threshold concept, Row 2 in Table 1) in presenting a conception of the overall level of economic activity. The phenomenon of the demand for money (Figure 1) becomes a dimension of the phenomenon ‘overall level of activity in the economy’. In Figure 2 we concentrate on the dimensions of this phenomenon that are highlighted by the conception in the ‘IS/LM’ model. The phenomenon is represented by the grey circle which is specific given form by the dimensions that

are highlighted in the boxes around its perimeter. The conception of the demand for money that is embedded in Figure 2 has two critical dimensions: interest and income and it is the deeper level of theory presented in Figure 2 that provides the context for conceptualising the demand for money in these terms.

Figure 2: Dimensions of the ‘overall level activity in the economy’ as conceived in the ‘IS/LM’ model



The relationships between the dimensions in Figure 2 are more complex than those in Figure 1. They are generated by the use of the modelling procedures (Table 1, Row 3) of *equilibrium, ceteris paribus and elasticity* in the context of the discipline threshold of interaction between markets (Table 1, Row 3). Discernment of simultaneous variation in each of the critical dimensions is not sufficient to understand the conception of the economy that is represented here. Once, a conception of the level of activity in the economy in terms of the IS/LM model has been established, new light is shed on the more basic conceptions (such as the demand for money) that act as critical dimensions in understanding the more complex phenomenon. The threshold concept of interaction between markets and the procedural concepts that are necessary to operationalise this concept acts as a ‘keystone’ binding conceptions together.

We can now outline the key pedagogical issues in supporting students’ acquisition of discipline threshold concepts. First a threshold concept acts as a keystone bringing form and robustness where previously there was a collection of ideas, in this case enabling the learner to analyse within the demand and supply framework with which they are familiar. In the words of Entwistle (2005, p.) ‘In developing their conceptions, students experience the limitations suggested by Meno’s paradox: an adequate conception often requires a student to create links with a broader conceptualisation of the topic, which has to be built from the very ideas that the student has yet to understand.’

Second, the conception of ‘demand for money’ which is a critical dimension of the conception of overall activity in the economy in Figure 2 is removed from direct experience and can only be experienced hypothetically. Comparative static analysis is the procedural device developed by the discipline to make this hypothetical experience possible. Third, the relationships between the dimensions in Figure 2 are directed by the procedural thresholds in Row 3 of Table 1. That is, the dimensions become visible through the use of the procedures. Understanding the discipline threshold requires an awareness of how, and why, it is generated through the use of the procedural thresholds. In the terms used by McCune and Hounsell (2005) row 3 in Table 1 refers to the ‘way of practising’ in the discipline and Row 2 in Table 1 refers to the ‘way of thinking’ in the discipline. An additional characteristic of threshold concepts is that in their use they bind these ways of thinking and practising together (Davies and Mangan 2005). Fourth, since the acquisition of threshold concepts transforms understanding of previously acquired subject knowledge, students need to be ready to accept that at each stage in their learning that their understanding is provisional. This problem becomes most intense when the acquisition of a new threshold concept transforms understanding of a previously acquired threshold concept: an inevitable outcome if threshold concepts work together in a web to define the way of thinking and practising in a subject.

To address these problems we propose four principles:

- ◆ *Highlight variation to ensure there is a sufficient foundation of basic concepts to make it possible to work towards acquisition of the threshold concepts* This addresses the first problem by providing the learner with a base of conceptions that may be open to re-working through subsequent teaching and learning.
- ◆ *Help students to integrate their understanding through re-working their understanding of previously acquired concepts in the light of threshold concepts*: this addresses the first and second problems by treating the acquisition of new concepts as bound up with the re-working of previously acquired ways of thinking. It helps students to think of their learning in terms of building a coherent structure (Bransford *et al*, 2000).
- ◆ *Expose the way in which scholars in the discipline use procedural thresholds by highlighting variation in the use of key procedures*: this addresses the third problem.
- ◆ *Help students to regard their understanding as provisional and to tolerate uncertainty*: this addresses the first and fourth problems. Students have to learn ‘incomplete’ conceptions in order to make more ‘complete’ conceptions accessible to them.

4 Pedagogical principles exemplified

To put these principles into practice the ‘Embedding Threshold Concepts in Undergraduate Economics’ project has developed three types of activity: ‘reflective exercises’, ‘problem-focused exercises’ and ‘threshold network exercises’. In this section we describe and exemplify each type of activity and

explain how they aim to address the pedagogical principles. We draw upon evidence gathered through trialling the activities in four universities during the academic year 2005/2006. Through this trialling we sought to identify unforeseen issues in the design of the activities and the demands on students and lecturers. We also aimed to gather evidence that would confirm or conflict with our design principles. We did not at this stage aim to collect test data on students' achievements. The average prior achievement of students varied significantly across the four institutions. A further source of variation lay in whether students were studying economics or another subject (such as Business Studies) as their main discipline. We have not so far found any significant relationship between prior achievement and the ways in which students have responded to these exercises. Data were also gathered in the form of evaluations from staff and in a small number of instances we also gathered data through in-depth interviews with students who had recently completed an exercise. Our interpretation of these data was informed by the comments of the project's external evaluators and colleagues from each of the partner institutions in the project. Two common elements in the exercises were the provision of a written commentary on the tasks and a reliance on group work for the completion of the activities. Unsurprisingly (Bartlett 2006), these features were welcomed by students.

Reflective Exercises

An example of a reflective exercise is presented in Appendix 1. Our 'reflective exercises' begin by posing an applied question in economics (for example, 'What are the economic arguments on whether a football club should sell an important player?'). The phrasing of the question was intended to make it accessible to students, so that it is possible to conceive of an answer being provided on the basis of 'everyday knowledge' which might be contrasted with an answer that might be given by an economist. The first part of the exercise aims to get students to recognise alternative ways of framing an answer to the problem. If students meet a problem that is already framed by the concepts and procedures of a discipline they miss the opportunity to see how and why scholars frame the problem in this way. The 'framing' part of this activity addresses principles 1 and 3: *Highlighting variation to ensure a sufficient foundation of basic concepts and exposing the way in which scholars use procedural thresholds*. Part of the framing activity for an exercise on money is reproduced here as Table 2. Students are asked to tick however many of the statements they think appropriate.

Table 2 Part of the framing activity for a Reflective Exercise on Money

a	As a student, when you graduate and get a job your income will rise and you will demand more money in order to spend more.	
b	For many students their money demand is their student loan.	
c	Income is what we get paid over a certain period of time, over week, month or per term, whereas money is what we have in notes and coins or in the bank at a particular point in time.	
d	The quantity of money is the amount of notes and coins issued.	
e	The quantity of money is the amount of notes and coins in circulation and certain types of bank deposits.	
f	What I have in notes and coins and in my bank account today is my income.	
g	What I have in notes and coins and in my bank account today is my money balances.	

The choice of items here is intended to highlight dimensions that are critical to the discrimination of economic phenomena: e.g. money and income, stocks and flows. Another part of the framing activity focuses on opportunity cost. Table 3 shows the percentage of students selecting each of the options in the framing questions for the activity ‘Money – just another good?’ The percentages add up to more than one hundred in each row because students could choose as many options as they wished. Options which scored close to 0 or 100 showed little or no variation across the cohort of students and a number of these options were removed from later versions of the activity. We found no evidence of any effect of prior attainment on the distribution of options selected in these exercises.

Table 3 The proportion of students selecting different options in Framing Questions for the activity ‘Money – just another good?’

Question	Percentage of students selecting each of the options available for each question						
	a	b	c	d	e	f	g
A	100	0	20	20			
B	0	60	0	40	20	70	100
C	60	0	40	80	10	10	
D	0	0	80	60	70		
E	19	89	3	0	0	35	16

Students were then able to compare the way they were framing the problem with the way in which an economist might frame the problem. This opportunity was provided through feedback on each part of the framework. The feedback sought to expose the reasoning behind the way in which an economist might frame the problem addressing Principle 3 *Expose the way in which scholars in the discipline use*

procedural thresholds by highlighting variation in the use of key procedures. Students were then presented with a variation on the initial question and asked to provide a coherent response to the problem, drawing on the feedback they have received. It is at this point that students are asked to integrate their understanding addressing Principle 2 *Help students to re-work their understanding of previously acquired concepts.*

One difficulty that we encountered in the design of these exercises was how to phrase the feedback in a way that avoided lapsing into a presentation of the ‘textbook answer’. The danger here was that students might interpret such exercises as keeping the ‘right answer’ hidden until part way through, and thus, perhaps, encouraging a strategy of waiting till the ‘right answer’ was presented in a form that could then be memorised. To counteract this problem, feedback was revised to cast it more in terms of a narrative which might express an economist’s thoughts as they framed the problem, recognising the difficulties they faced in the task. Evidence from lecturers’ observations and subsequent interviews with students indicated that students’ engagement with this part of the activity was high. Students were directly engaged in clarifying basic concepts and threshold procedures so it appeared that design principles 1 and 3 were being enacted.

However, it was not evident that the second half of the exercise was sufficiently supporting students’ ability to re-work and integrate their thinking (design principle 3). This could reflect the time that lecturers allowed for students to complete the activity, the conception of teaching held by lecturers and the conception of learning held by students. The activities were included in standard one hour slots and in a number of instances lecturers aimed to complete the activity using only part of this of this time. The belief that teaching consists in transmitting information remains widespread and this belief generates a pressure on lecturers to make sure that sufficient content has been covered in their teaching sessions. When the activities were used within a standard lecture slot in a large lecture theatre the problems with engagement in the second half of the activity were most noticeable and quite likely due to students’ expectations of the large lecture format. Nevertheless, we remain sceptical as to whether the current design of the activities provides sufficient support for students’ re-working and integration of their thinking. This can be illustrated through an activity that focused on the possible gains from trade. A number of students who framed the problem in the way that might be expected from an economist, nevertheless failed to integrate their understanding of the discipline in developing their answer to the final problem in the exercise. This required an understanding of the idea of comparative advantage in terms of opportunity cost and few students were able to demonstrate this kind of understanding. For example one student who was interviewed believed that they had understood the comparative advantage principle, but then proceeded to explain the principle purely in terms of absolute advantage.

Problem focused exercises

An example of a problem-focused exercise is presented in Appendix 2. The title of this type of exercise reflects a debt to problem based learning, but no intention

to rigorously follow PBL principles. Our problem focused exercises require less substantial initial data, less time and more structured ‘scaffolding’ for students than would be expected in a PBL activityⁱⁱ. Crucially, the accompanying tasks identify the phenomenon which will form the focus of the learning rather than leaving this identification to the learners as would be normal in a PBL activityⁱⁱⁱ. Our approach is somewhat similar to that developed through a project involving Oxford Brookes and London Metropolitan Universities in 2004/2005 (Pigott and Kilminster 2004). It also has some similarities with the use of case studies as advocated by Carlson and Velenchik (2006). An important common thread in each of these examples is the value of cases that students believe are relevant to their interests in order to motivate initial engagement (Siegfried and Sanderson 1998, Watts (1998).

In the problem-focused exercise in Appendix 2 the initial task for students is to identify the explanations for a phenomenon that are suggested by the text. The phenomenon is a difference in price between two countries for the same product. The text includes hints at possible explanations. A representative for Apple refers to differences between ‘the economic model’ in each country and the cost of providing the service. The final paragraph suggests that if there were no barriers to mobility of customers between the markets then the price difference would disappear. The task for students is to identify that these explanations are suggested in the text and then to begin to interpret and critically examine these possible explanations. Our problem-focused activities assume that students cannot carry out these steps without ‘scaffolding’ that draws their attention to variation in possible theoretical explanations (Principle 1). Students are given three theoretical constructions that could explain a difference in price between two markets. These theoretical constructions show different relationships between the dimensions of the phenomenon: price, cost, demand and output. To complete the task students have to consider which of these explanations is most appropriate given the evidence they have about the context. This is followed by a second task in which asks students to relate different diagrams to different interpretations of the data. This use of variation (Principle 1) is the first way in which these exercises are distinguished from other problem-based approaches to learning.

The final task aims to address Principle 2 (*helping students to integrate their understanding*) by guiding students’ reflection on the way they have attempted to analyse this problem. Students are asked to choose one out of four named concepts that they could manage without in their analysis of the problem. This idea owes something to a suggestion by Hansen (1998, p.89). The chosen concepts are either procedural or discipline thresholds (Table 1). One of the issues that we have encountered in the design of these activities is how much integration to encourage. Evidence generated in the first stage of the project (Davies and Mangan 2005) showed that a key difference between lecturers’ and students’ analysis of economic problems lay in the number of different economic ideas which were brought coherently to bear upon the problem. However, the design of an exercise to support students’ learning needs to be sensitive to their readiness:

how many ideas are they currently capable of bringing together? Diagrams in economics are used to ‘bring ideas together’ but this may be lost on students who learn diagrams as fixed entities to be deployed in given circumstances rather than the expression of a particular set of ideas in a particular context. Principles 1 and 2 provide a useful guide for the design of an exercise, but professional judgement is still required as to adjust the demand of an exercise according to students’ readiness.

Threshold network exercises

Our third type of exercise concentrates on the design principles of getting students ‘relating to discipline concepts’ and ‘connect concepts within the web’ by getting students to think about the importance of threshold concepts as a unifying framework. The exercises give a short applied problem and a list of concepts that might be used to make sense of the problem. Students are asked to choose which concepts they will use and provide an account of how using these concepts together generates a good analysis of the problem. Coming to an understanding of the power of these concepts in a wider range of problems may deepen the students understanding in earlier applications. Students are again given feedback describing how an economist might carry out the task that has been set for them. This activity mainly targets Principle 2 (*Helping students to integrate their understanding*).

5 Discussion

Our development of activities for teaching and learning has progressed alongside development of the idea of ‘threshold concepts’ and the relationships between this idea and other aspects of the theory of learning. Developments in our understanding of the relationship between threshold concepts and variation theory have been particularly influential in our thinking about the design of activities for teaching and learning. However, the process of trying to develop practice has also prompted reflection on the idea of threshold concepts and the implication of this idea for pedagogic principles. Consequently, what we have presented here is work in progress. We are very conscious, for example, that our activities have not directly addressed one of the four pedagogic principles (*Helping students to regard their understanding as provisional and to tolerate uncertainty*).

We have also observed that the different types of activity have not been equally popular with lecturers and students. Lecturers in our four partner institutions have been much more ready to try out the reflective exercises than either of the other two types of activity, with the ‘threshold network’ activities being the least popular. We can speculate as to the reasons for this, but at present we are not able to offer systematic evidence to shed light on the issue. It could be that principles 1 and 3, which are emphasised strongly in Reflective Exercises are more pertinent to

lecturers' intentions in the first year of undergraduate courses. The aim of integration may be seen as a task for levels 2 and 3. However, it might equally be the case that insufficient support for integrating understanding and re-working of prior knowledge is provided in these exercises. The aim may be possible if the implementation in the activities was better. Given the importance of integration and developing the structure of understanding to the whole 'threshold concepts approach' this is an important issue for further work. It may be that further work will help to clarify the pedagogical principles that have been suggested here.

Nevertheless, we do believe that these examples show (1) that when the insights of variation theory are combined with those from threshold concepts they can be used to develop a coherent analysis of the problems facing learners and (2) that it is possible to derive pedagogical principles from the idea of threshold concepts and that activities that are devised on the basis of these principles are distinctive when compared to other approaches to teaching and learning which at first sight are quite similar.

In the coming academic year we will be carrying out investigations that examine the whole of the learning experience, including the use seminar groups who use our activities and those who do not on the same module. We were already of the view that it is important in embedding to consider assessment, since assessment is the main student driver. This view was enforced in several ways by our experience during the year and we will be developing assessment tools and strategies and this will enable us to start assessing the overall impact on the learning process. We will also found our interviews with students useful in this context and in the coming year we will be carrying out interviews focused directly on the student responses to particular parts of our material in the period immediately following their use to conduct a detailed analysis of the variation in students' understanding. We have also discussed the use of web CT in our project group to provide feedback tailored to the particular student's replies. The use of this medium does also have other advantages such as allowing the staged build up of models that may aid student's understanding. However, it does have the disadvantage of being seen as an 'optional extra' both by students and staff, unless clearly built into a programme (by for instance making it clear that it relates to the assessment in some way). We intend trial some web CT versions of our materials in the coming year.

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Appendix 1

Reflective Exercise 3: Externalities

What are the economic arguments on whether large cities that have congested roads should charge a road tax?

Learning Focus

Developing an understanding of the working and limitations of the market mechanism by considering an externality.

Threshold Concepts

that are pivotal to this learning are Welfare Economics and Partial Equilibrium. Other threshold concepts used are marginality and economic modelling.

Setting the framework for investigating this question

- **A Which of the following are essential in deciding whether congestion should be regarded as an economic problem?**

Tick however many of the following you think appropriate

a	It is the individual's choice as to whether they use the crowded roads. This is a free country and it is of no concern to others.	
b	The crowded roads mean that people are late to work and other appointments.	
c	An individual deciding to travel at peak time imposes costs on other people who are also travelling by increasing their delay and increasing their petrol costs.	
d	Travelling at peak time increases pollution because of extra fumes from the slow moving traffic and this affects other people than the motorists.	

- **B Before the introduction of any system for paying for roads, the number of cars on a stretch of road at a particular time will reflect:**

Tick however many of the following you think appropriate

a	The number of drivers for whom the benefits of using the road just cover all the costs incurred by their journey.	
b	The number of drivers for whom the benefits of using the road for that journey are equal to or outweigh the costs to them of using the road.	
c	The maximum number of drivers that can be accommodated before additional drivers start causing increased costs for others.	

■ C Translating this argument into a diagram:

On the diagram price is used to measure the marginal benefits and costs of the journey. Quantity measures the number of drivers using the road at a particular time.

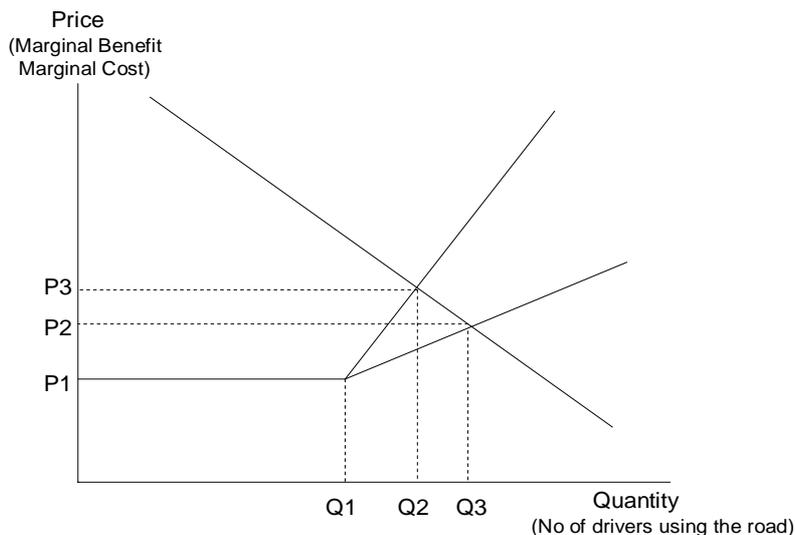
Label the lines which you think show:

- The benefits to the drivers from using the road (MB, marginal benefit).
- The cost to each additional driver of using the road (MPC, marginal private cost).
- The cost including those imposed on others of each extra driver joining the road (MSC, marginal social cost)

Which point on the axes shows?

- The number of drivers who would use the road if there was no road pricing?
- The marginal cost to each additional driver of using the road when there is no congestion?
- The marginal cost to each additional driver of using the road at the level of road use when there is with no road pricing?
- The number of cars that would use the road if individual car drivers had to bear the costs they caused to others as well as they cost s they cause to themselves?

Figure 1: The optimum use of roads



■ D What does this diagram show would be the most efficient level of road use compared to the unregulated market?

Tick whichever of these you think is appropriate

a. There would be no congestion	
b. Road use would fall by from Q3 to Q2	
c. It would be where the costs each driver pays for the journey equals the benefits they get from using it.	
d. Road use would fall from Q3 to Q1	



Now write about the ideas that an economist is using to analyse this situation

1. What ideas that are used in economists' argument are not usually used in everyday reasoning?
2. What conclusions do economists come to that a non-economist might not?

What are the economic arguments on whether large cities that have congested roads should charge a road tax?

Setting the framework for investigating this question – the approach of economics

■ A. Which of the following are essential in deciding whether congestion should be regarded as an economic problem?

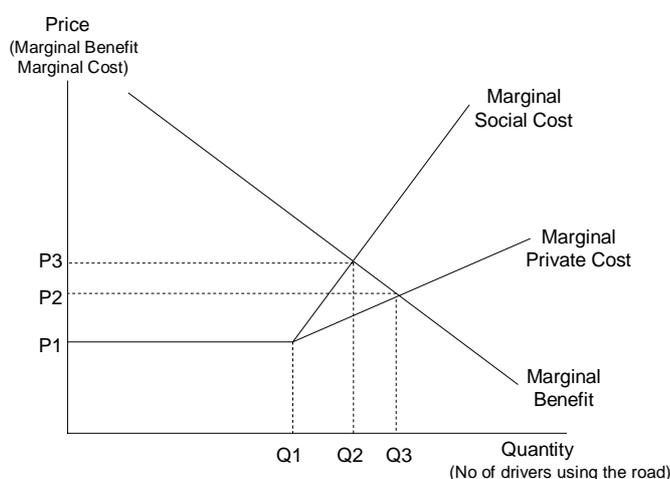
In economics a road that becomes congested is a scarce resource and we are concerned with the effects of peoples' choices of using it on the overall welfare of society. If I use my car to travel to work when I know that the road will be congested I am making a choice amongst alternatives. Choices in economics are not always between pleasant alternatives: I could get a job elsewhere, travel at different times or by public transport. We assume that people do what best suits them of the alternatives available. However, this may not always be the best for society, as by travelling on a congested road I add to the problems faced by others – I marginally decrease the speed that everyone else is travelling and therefore make them all a tiny bit later, cause them to raise their fuel consumption and their emissions a little. I don't have to pay for any of these costs I impose on others, so it does not enter my personal calculations. (Similarity other motorists don't take into account the extra costs they imposes on me!) This is the economic problem – (c), not (a) or (b). This makes (d) a problem too in that I don't have to pay for any increase in emissions that result from my use of the road. Other people – those living near the road, driving other vehicles and through atmospheric change those living far distant from me all have to bear this cost of my journey and virtually none of this cost falls on me.

■ B. Before the introduction of any system for paying for roads, the number of cars on a stretch of road at a particular time will reflect ...

Without any road pricing system car drivers will go on a journey at a particular time if the benefit to them equals or exceeds the costs to them regardless of any effects on others (so that the correct answer is (b) not (a)). We could rank the car drivers in terms of how much benefit they personally would get out of using the road. To begin with additional drivers joining the road will face costs no different from if they had been the first on the road. However, there will come a point when the road will start to get congested. Drivers will slow each other down. Drivers who join the road when there is already some congestion will face higher levels of cost because their journey will be longer. The more cars that are on the road the longer the journey will take and the higher the cost to each new driver joining the road. Assuming that each successive person joining the road gets slightly less benefit from doing so and also tends to face slightly higher costs we will reach a point where benefit to the additional driver just equals cost to the additional driver and this is the point that will determine the number of cars on the road (not (c) where there is no congestion).

■ C Translating this argument into a diagram

Figure 2: The optimum use of roads - labelled



1. The number of drivers who would use the road if there was no road pricing? **Q3**
2. The marginal private cost to each additional driver of using the road when there is no congestion? **P2**
3. The marginal cost of each additional driver of using the road at the level of road use when there is with no road pricing? **P3**
4. The number of cars that would use the road if individual car drivers had to bear the costs they caused to others as well as they cost s they cause to themselves? **Q2**

■ D What does this diagram show would be the most efficient level of road use compared to the unregulated market?

Compare your answer with an economist's answer

With this kind of question, efficiency in economics is taken as applying to society overall, not the individual. An economist would consider the costs and benefits and look at removing any situation where the costs of a particular journey outweigh the benefits overall, not just to the individual. If we consider the journeys that are shown as Q2-Q3 in our diagram, for each individual driver the benefits to them are greater than the costs to them. As a purely private decision, they should undertake the journey. However, once we take into account the costs to others, the benefit from those drivers' journeys is less than the costs. The economist would refer to the marginal social benefit of these journeys being less than the marginal social costs and conclude from this that these journeys should not be undertaken. Below Q3 the benefits of each driver's journey are greater than the costs, including the costs imposed on others, so from society's viewpoint as well as the private, individual viewpoint, there is a net gain from undertaking the journey. So a certain amount of congestion would have to be lived with. Thus (b) is the correct answer.

Feedback: The ideas that economists use

1. What ideas are used in economists' arguments that are not usually used in everyday reasoning?
 - (a) **Opportunity cost** - the economist considers that there is a cost to using scarce resources even if they are not directly charged for - in this case the roads and other factors such as people's time.
 - (b) **Welfare economics** - The congestion is not a 'bad' simply because it slows up the traffic and frustrates drivers: it is a problem because it means people are imposing costs on others that they are not taking account of in their personal decision making - an externality. Economics considers these costs should be taken account of to improve the efficiency of the economy and economic welfare. We are examining the effect on the economy as a whole, not individuals.
 - (c) **Marginality** - we need to consider the benefits and costs (including the externalities) of the marginal journey and consider if this journey is worth undertaking from society's viewpoint (not the total or average).
 - (d) **Partial Equilibrium** - we start by considering demand and supply as the resource allocation mechanism, but recognise that at the equilibrium position there is market failure - that is there are problems in the allocation by this method, due to the externality of congestion. Prices are incentives and by changing prices we can alter use of resources such as roads. The aim with road pricing is to charge a price that reflects the marginal social costs.
2. **What conclusions does an economist come to that a non-economist might not?**
 - (a) Charging may be a sensible way to reduce traffic congestion if it reflects the externality costs.
 - (b) Although we should reduce congestion this will not be to the point where there is no congestion.

Appendix 2

Problem Focused Exercise 6: Pricing of Music Downloads

Learning Focus

An understanding of the approach to the determination of prices and the effect of market power and elasticity.

Threshold Concepts

that are pivotal to this learning are incentives, economic modelling and elasticity.

The Scenario

Apple's iTunes music store is charging a higher price to UK consumers than those elsewhere in Europe.

- **Task 1**

Read the attached extract

- (a) The information shows that UK consumers are paying a different price for downloads than consumers elsewhere in Europe. What explanations for this situation are suggested by the text?
- (b) Look at the 'Diagrams to explain the difference in price of Downloads'. Which pair of diagrams provides the best explanation of what is happening (Can you produce a pair of diagrams that provide an even better explanation)?
- (c) What is your explanation for the position and slope of the curves in your preferred diagram?
- (d) Why have you discounted the other diagrams?

- **Task 2**

- a) Prepare an **economic case** to justify Apple's position
- b) Prepare an **economic case** to support the stance adopted by the UK Office of Fair Trading.

- **Task 3**

Suppose you had to conduct an economic analysis of this problem without one of the following economic concepts – consumer surplus, elasticity, the margin, interaction between markets –

- (a) Which of the four concepts would you do without?
- (b) Why would this be the concept to do without?
- (c) How would the absence of that concept affect your analysis?

European Commission Launches iTunes Price Probe

by [StaffStaff](#), 7:00 AM EST, February 25th, 2005

The European Commission (EC) has confirmed it is looking into allegations that Apple's [iTunes Music Store](#) (iTMS) discriminates against consumers in Great Britain by charging them more to download the same song than it charges other European music buyers.

EC spokesman Jonathan Todd said the investigation is in "the early stages" and would not give a time frame for when a decision would be handed down.

Apple's pricing policy was [brought to the EC's attention in December 2004](#) by the [British Office of Fair Trading](#), which was itself made aware of the situation by the British Consumer Association, now known as [Which?](#)

In the UK, the iTunes Music Store charges customers 79 pence (euro€1.14/US\$1.50) to download a single track. The same song costs €0.99 (68 pence/US\$1.30) when it's downloaded from Apple's other European music Web sites.

Apple defends its pricing structure saying it is based on market influence and the price it pays for each song in each country.

"The underlying economic model in each country has an impact on how we price our track downloads," Apple said in a statement. "That's not unusual. Look at the price of CDs in the US versus the UK. We believe the real comparison to be made is with the price of other track downloads in the UK."

Which? and the British Office of Fair Trading contend Apple's refusal to allow cross-border shopping is in contravention of European Union laws that stipulate British shoppers should be able to enjoy the same advantages as their European counterparts. But because Apple does not allow those with a UK-based address or credit card to use the French or Germany iTMS sites, those in the UK can't enjoy equal pricing.

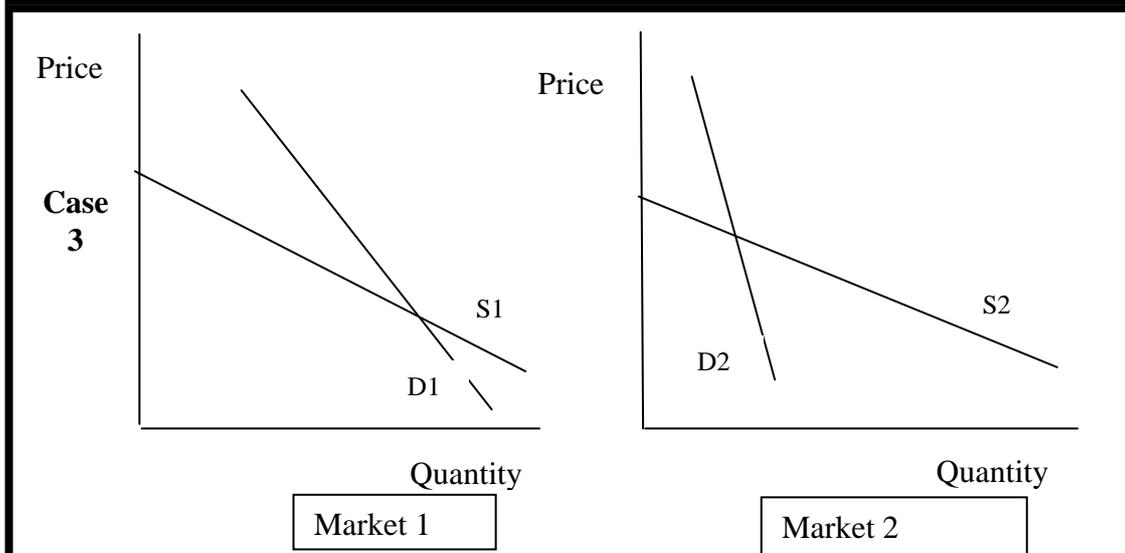
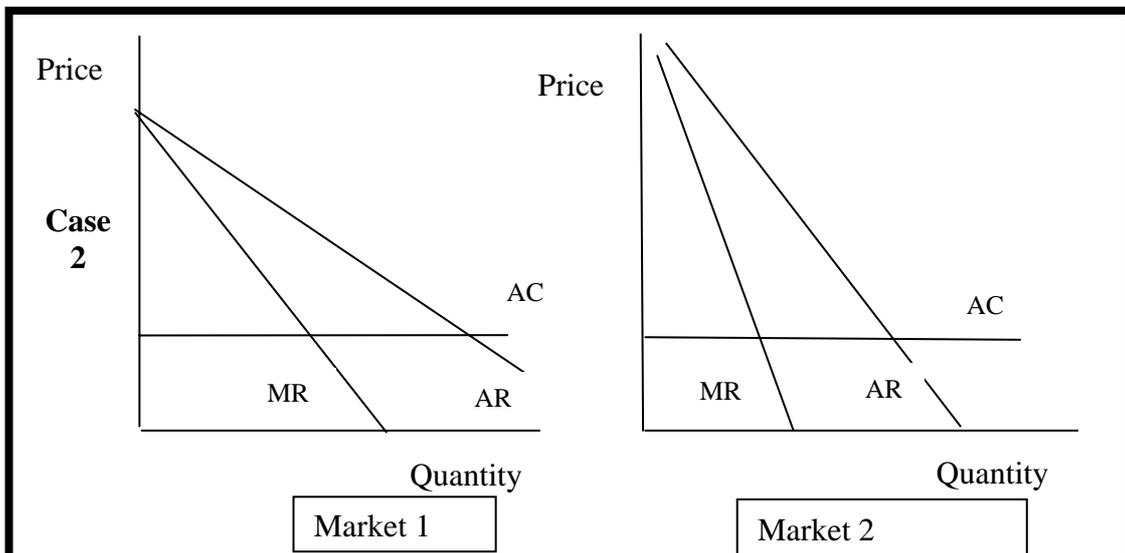
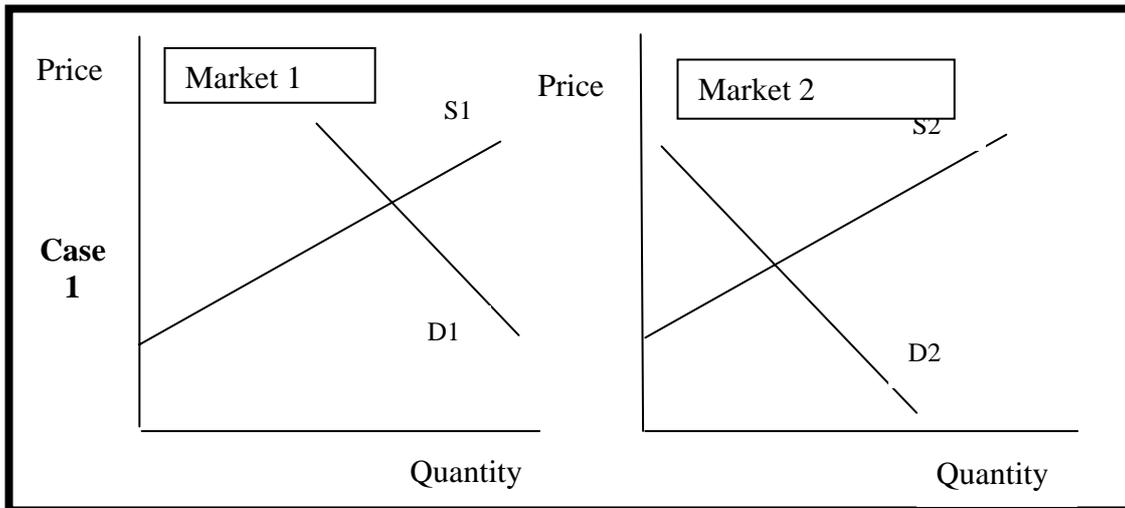
Feedback

Task 1

A first thing to decide with problems like this is whether to analyse them in terms of markets or firms. If you decide to analyse in terms of markets the analysis presumes that there are many firms and that there is a ruling market price which more or less governs what each firm charges. In this instance, the focus is on an individual firm that has a monopoly of its particular product. There are competing opportunities for consumers, but they are imperfect substitutes. Case 2 is the only one of the cases where the problem is analysed in terms of a single producer.

The question now becomes one of deciding on the shape and position of the curves. The case made by Apple in the text attributes the difference to a combination of cost and market conditions. They claim that costs are higher in the UK – suggesting that the AC line would be higher in one of the diagrams than the other. There is no evidence provided in the text to suggest that AC is anything other than a straight line, but a case could be made for suggesting that there are some fixed costs due to advertising the service. So you could argue that the AC lines should be drawn differently from those in Case 2. If Apple was seeking to maximise profits it would set its price where output leads to $MR=MC$, which would be the same as $MR = AC$ if AC is horizontal. In these circumstances a difference in the slope of the demand curve (and therefore AR and MR) could lead to a difference in the profit maximising price even if the supply costs were identical in both markets. This can be shown by drawing a vertical line from the point where $AC=MR$ to the AR line – this would be the profit maximising price. But why might the elasticity of demand be different between the two markets? One reason could be that there are closer substitutes in one market than another, alternatively, consumer tastes might dictate that the product is regarded as more of a necessity in one market than the other – something everybody just has to have.

Using Diagrams to Explain the Difference in Price of Downloads



ⁱ The Embedding Threshold Concepts in First-Year Undergraduate Economics Project is based at Staffordshire University, UK web site: <http://www.staffs.ac.uk/thresholdconcepts>

ⁱⁱ The Buck Institute for Education in California has been very active in developing problem-based learning in economics. Their web site can be found at <http://www.bie.org/> and a related site at <http://www.pbl-econ.org/> See also Maxwell and Bellisimo (2003) Problem Based Economics, Overview, Buck Institute for Education.

ⁱⁱⁱ This forms a substantial part of the seven stage PBL structure advocated at the University of Maastricht. (See <http://www.unimaas.nl/pbl/>)